

A New Species of *Liparis* from Japan and Korea

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Plants recognized as *Liparis koreana* (Nakai) Nakai ex W. T. Lee (Orchidaceae) in Japan and Korea is morphologically distinct from the type specimen of that species in the following points: flowers sparsely arranged (vs. closely arranged in the type); apex of anther cap mucronate (vs. beaked), lateral sepals twisting and enfolding the lip (vs. extending to the apex of the lip). Since these plants do not correspond with any known species, it is described as a new species, *Liparis koreojaponica*. The taxonomic status of *L. koreana* is reviewed.

Keywords: Japan, Korea, *Liparis*, new species, Orchidaceae

Liparis Rich. (Orchidaceae), consisting of over 400 species, is widely distributed in tropical and temperate regions worldwide (Cribb & Goovaerts 2005). Section *Liparis*, one of the 19 sections of the genus, is defined by the undeveloped pseudobulb at anthesis and two subfleshy non-ribbed leaves arising from the apical part of the pseudobulb (Garay & Romero-Gonzalez 1999).

Liparis koreana (Nakai) Nakai ex W. T. Lee, assigned to sect. *Liparis*, was originally described as *L. makinoana* Schltr. var. *koreana* Nakai on the basis of specimens collected from Hekido (= Byeokdong), Heihoku Prov. (= Pyeongbuk) and Ranan (= Nanam), Kanhoku Prov. (= Hambuk) and inter Sankamen & Kamenkōkō (Sankamen = Samhamyeon), Kanhoku Prov. (= Hambuk) in North Korea (Nakai 1931, open circles in Fig. 4). *Liparis koreana* has often been recorded as occurring widely on the Korean Peninsula (Chung 1957, 1965, T. B. Lee 1979, Kim & Kim 1986,

W. T. Lee 1996a, 1996b, Kim & K. S. Lee 1997, Y. N. Lee 2002). Recently, Japanese plants called *Oh-fugaku-suzumushi-so*, or *Ezonokumokiri-so*, have been identified as *Liparis makinoana* var. *koreana* (Takizawa 2001). Our molecular phylogenetic study revealed that samples collected as *L. koreana* or *L. makinoana* var. *koreana* from South Korea and Japan have mostly identical sequences (Tsutsumi *et al.* 2007), suggesting that the Korean and Japanese samples are the same species. Examination of the type specimen of *L. koreana*, however, showed that plants currently referred to *L. koreana* in both South Korea and Japan are distinct from the type specimen and do not correspond to any published taxa. In this study, we investigated the taxonomic status of *L. koreana*, provide supplementary information not mentioned in the protologue and describe the misidentified plants from Korea and Japan as a new species, *L. koreojaponica* Tsutsumi, T. Yukawa, N. S. Lee, C.

S. Lee & M. Kato.

Taxonomy

Liparis koreana (Nakai) W. T. Lee (Fig. 1)

Liparis koreana (Nakai) Nakai [Bull. Natl. Sci. Mus. Tokyo 31: 151 (1952), comb. nud.] ex W. T. Lee, Lineam. Fl. Kor.: 1555 (1996), p.p. —*L. makinoana* Schltr. var. *koreana* Nakai, Bot. Mag. Tokyo 45: 107 (1931). —Type: North Korea, Heihoku Prov. (= Pyeongbuk), Hekido County (= Byeok-dong), Aug. 16, 1912, *H. Imai s.n.* (TI!)

Japanese name. Korai-suzumushi-so, Chosen-suzumushi-so.

Korean name. Cham-Na-Ri-Nan-Cho.

Distribution. Korean Peninsula.

Additional specimens examined. Little additional information was obtained from the paratype, *T. Nakai* (TI) from inter Sankamen & Kamenkôkô (Sankamen = Samhamyeon), Kanhoku Prov. (= Hambuk), North Korea, which has only fruits. We did not find the other paratype, *R. Saito* from Ranan (= Nanam) of Kanhoku Prov. (= Hambuk), North Korea in TI.

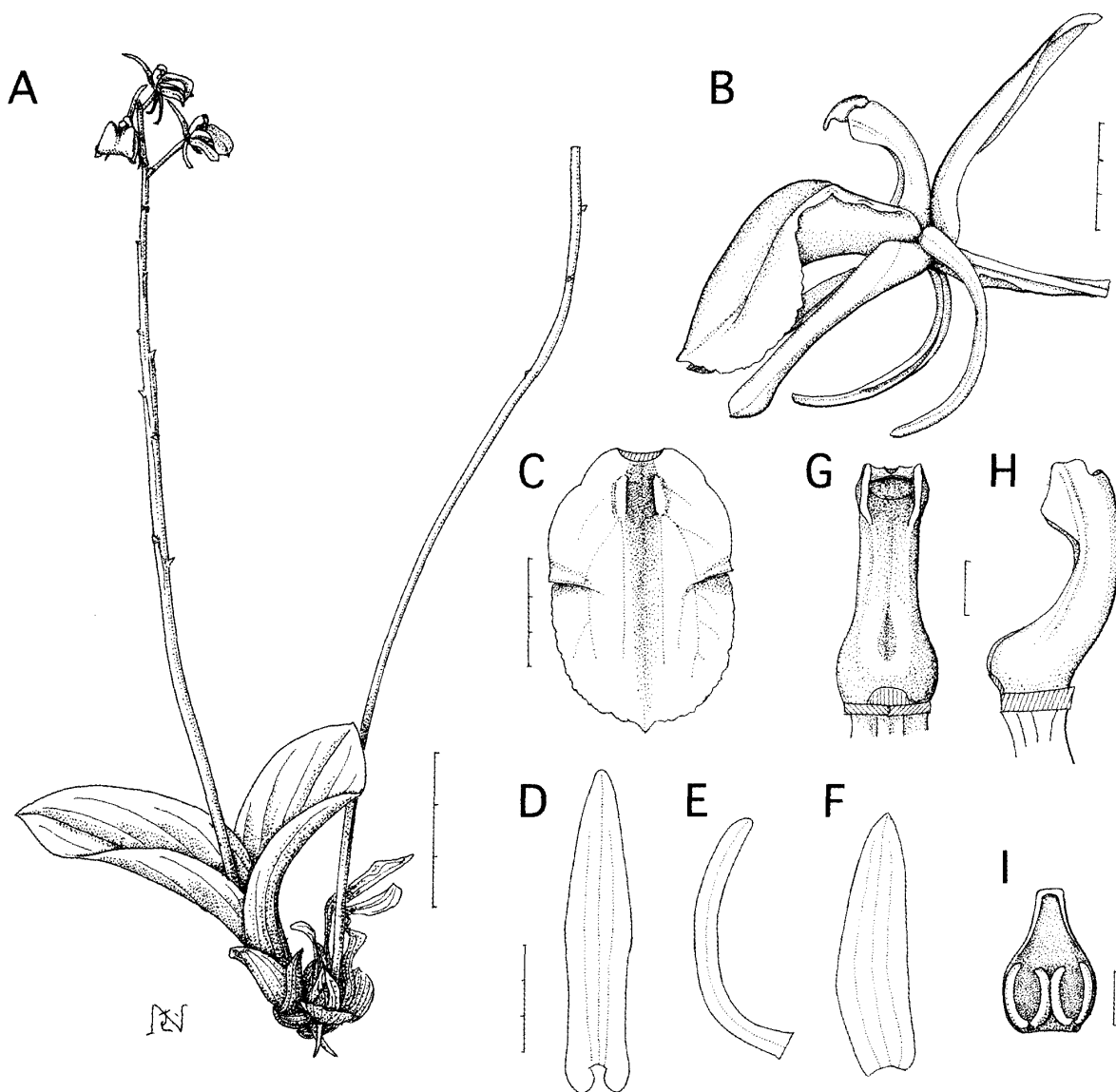


FIG. 1. Holotype of *Liparis makinoana* var. *koreana*. A: Habit. B: Flower, side view. C: Labellum. D: Dorsal sepal. E: Petal. F: Lateral sepal. G: Column, from below. H: Column, side view. I: Anther cap. A from an individual in holotype (*H. Imai s.n.*, TI), B–I from boiled flower of holotype. Scale bars = 3 cm (A), 3 mm (B–F) or 1 mm (G–I).

Notes. *Liparis koreana* was first described as a variety of *L. makinoana*, distinguished by longer and narrower leaves and narrower labellum (Nakai 1931). Here we add the following diagnostic traits not included in the protologue: flowers closely arranged (usually < 1 cm apart), and apex of anther cap beaked. In these traits, *L. koreana* is similar to *L. makinoana*, whereas it is clearly distinguished from the plants identified as *L. koreana* or *L. makinoana* var. *koreana* in Korea and Japan, which are described as a new species.

Liparis koreana has often been reported from the Korean peninsula (Chung 1957, 1965, T.

B. Lee 1979, Kim & Kim 1986, W. T. Lee 1996a, 1996b, Kim & K. S. Lee 1997, Y. N. Lee 2002). The descriptions by Kim & K. S. Lee (1997) and Y. N. Lee (2002) confuse *L. koreana* with *L. koreojaponica*. Descriptions of *L. koreana* by others (Chung 1957, 1965, Kim & Kim 1986, W. T. Lee 1996a, 1996b) mostly agree with the type specimen of *L. koreana*, although it is unknown which species occurs in the cited localities, Ganggye in Pyeongbuk Prov., Sambang, Anbyeon in Hamnam Prov. (currently called Gangwon Prov.) and Samsoo-Haesangjin in Hambuk Prov. (currently called Ryanggang Prov.) (see gray circles in Fig. 4).

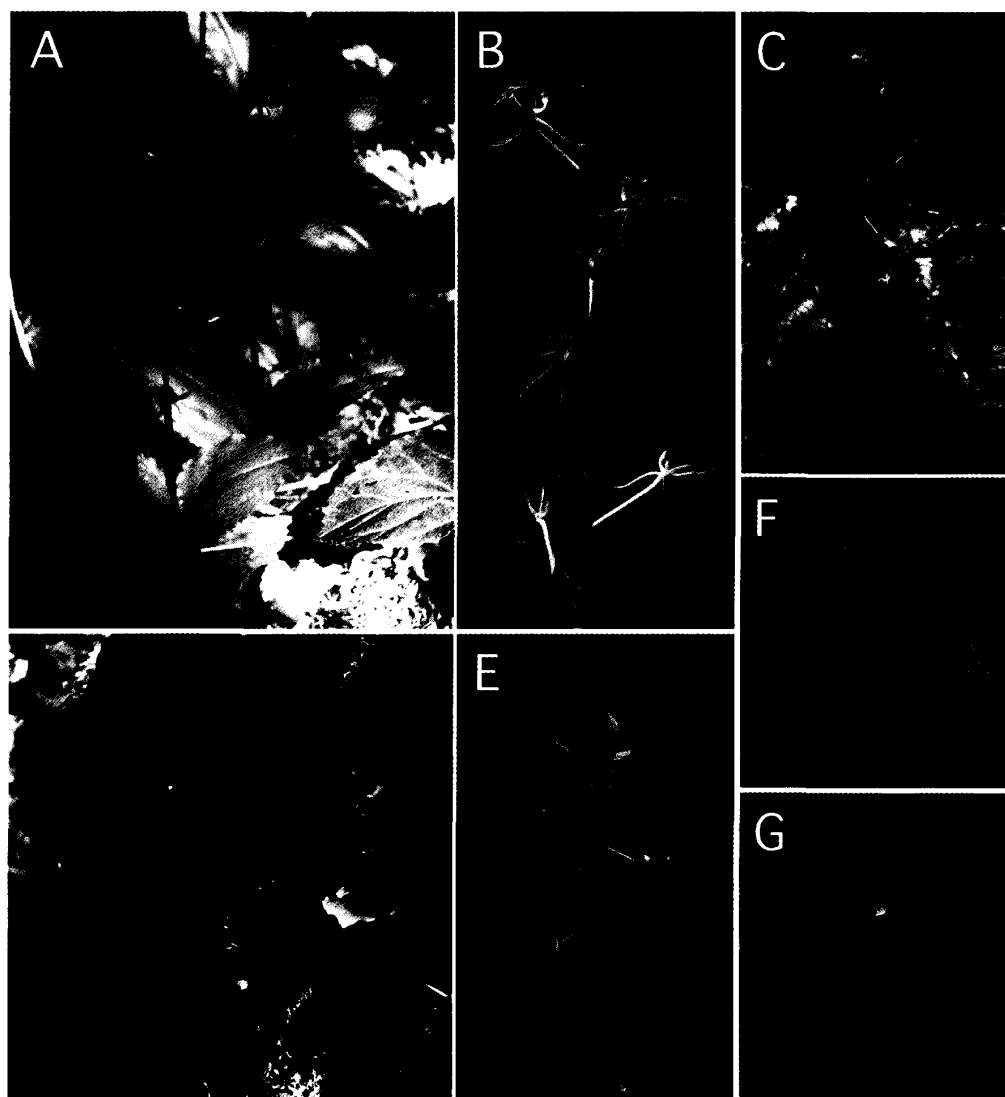


FIG. 2. *Liparis koreojaponica* (A–C, F) and *Liparis fujisanensis* (D, E, G). A, C, D: Habit (A, Hokkaido, Japan; C, South Korea; D, Ehime, Japan). B, E: Inflorescence. F, G: Flower, front view.

Liparis koreojaponica Tsutsumi, T. Yukawa, N. S. Lee, C. S. Lee & M. Kato, **sp. nov.** (Figs. 2–3)

A *L. koreana* operculo antherae apice mucronato, a *L. fujisanensi* inflorescentia longa laxiflora, et semine longo cum embryone parvo differt.

Typus. Japan, Hokkaido, Asahikawa, Kamui-cho, ca. 280 m, on fallen tree trunk along stream, Jul. 9, 2007, C. Tsutsumi, K. Watanabe & H. Hongo CT1111 (holo- TNS).

Pseudobulb ovoid, 1–2 cm long. *Leaves* 2, ovate-elliptic, obtuse or subacute, 10–20 cm long, 2–6(–9) cm wide, conduplicate, glossy, glabrous, margin entire or somewhat undulate, green; petiole 5–10 cm long, winged, nearly as long as blade. *Inflorescence* terminal, racemose, 15–35 (–50) cm long, with 4–16(–20) flowers; axis glabrous, ridged, green. *Bract* ovate, acute, 1–5 mm long, green. *Pedicellate ovary* clavate, twisted,

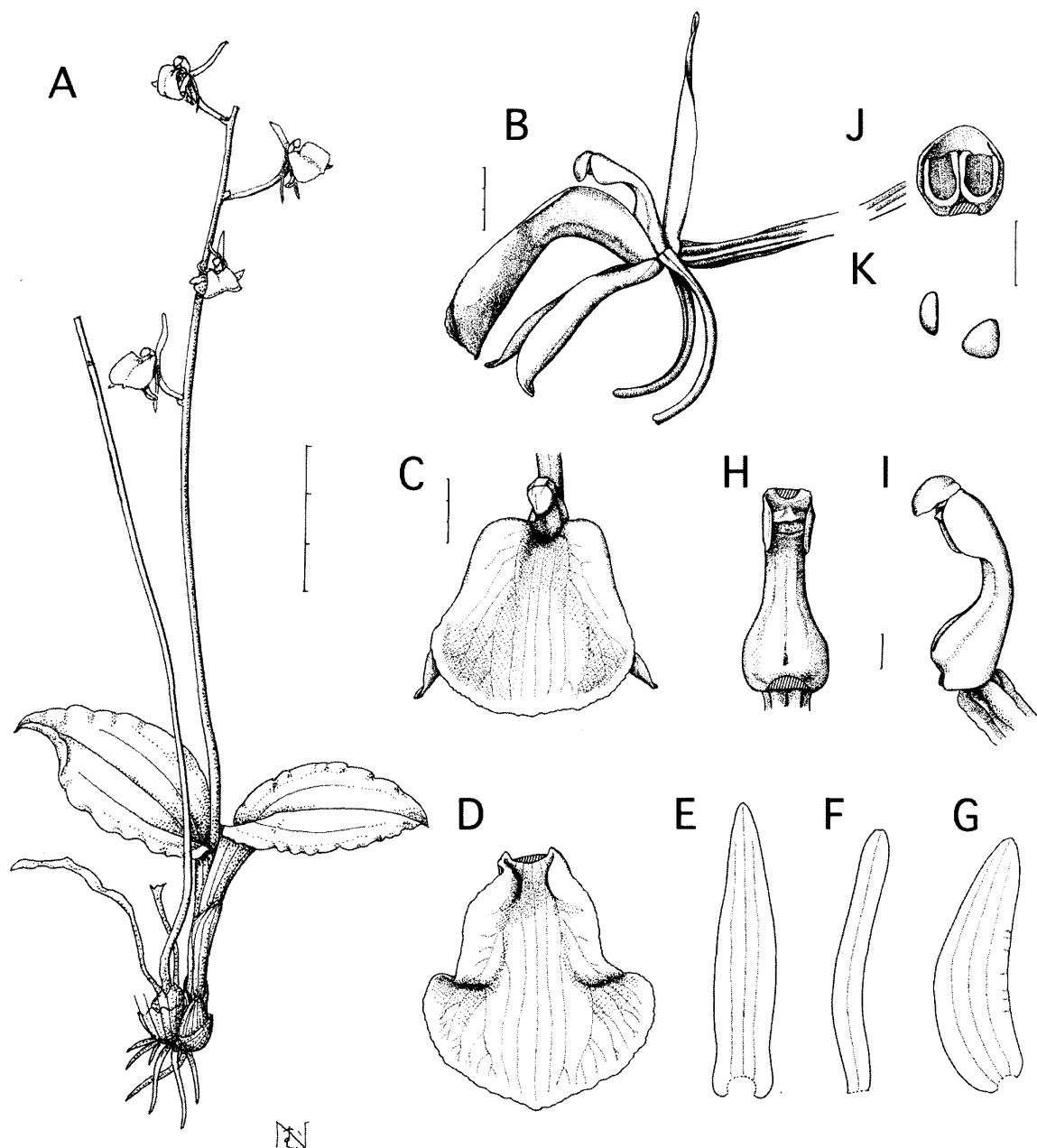


FIG. 3. *Liparis koreojaponica*, A: Habit. B: Flower, side view. C: Flower, front view. D: Labellum. E: Dorsal sepal. F: Petal. G: Lateral sepal. H: Column, from below. I: Column, side view. J: Anther cap. K: Pollinia. A from holotype (C. Tsutsumi, K. Watanabe & H. Hongo CT1111), B–K from C. Tsutsumi, K. Watanabe & H. Hongo L4. Scale bars = 3 cm (A), 3 mm (B–G) or 1 mm (H–K).

13–17 mm long, green, sometimes with purplish tint at base. *Dorsal sepal* linear-lanceolate, subacute, occasionally slightly revolute, erect or somewhat recurved, 10–11 mm long, 2–2.5 mm wide, purplish. *Lateral sepals* obliquely ovate or obliquely lanceolate, subacute, somewhat revolute, distally twisted, partially enfolding lip, 9–11 mm long, 2–3 mm wide, purplish. *Petals* falcate, linear, obtuse, strongly revolute, pendulous, sometimes slightly twisted, 10–12 mm long, 0.5 mm wide, purplish. *Labellum* entire or minutely erose, ovate-oblong, clawed, strongly recurved at middle, margins sometimes slightly revolute, apex obtuse or apiculate, 9–12 mm long, 6–9 mm wide, purplish or greenish purple. *Column* terete, incurved, with rounded wings, dilated at base, with shallow groove at base on ventral side, 5–6 mm long, green, pale green on ventral surface; pollinia 4 in 2 pairs, waxy, yellow; anther cap ovoid, mucronate, green.

Japanese name. Oh-fugaku-suzumushi.

Korean name. Keun-Kkot-Ok-Jahm-Nan-Cho.

Distribution and ecology. Japan (Hokkaido), South Korea: terrestrial, on rocks or on fallen tree trunks in forests.

Additional specimens examined: JAPAN.

Hokkaido. Ishikari: Keikawa, Jul. 9, 1891, *Miyabe* (SAPS 009833); Hassamu, Jul. 5, 1912, *S. Hayakawa* (TI); near Sapporo, Nopporo, Jul. 4, 1914, *K. Miyabe* (SAPS 009823); Sapporo, Maruyama, Jul., 1879, *K. Miyabe* (SAPS 009834); Sapporo-shi, Minami-ku, Mt. Toishi, Jul. 6, 1988, *M. Hara* 3508 (SAPS 009768); Soranuma-dake, Jul. 6, 1950, *S. Notani* (SAPS 009874); Soranuma-dake, Jul. 6, 1950, *S. Notani* (SAPS 009875). —Sorachi: Yuubari-shi, Yuubari-dake, Jul. 2, 1990, *Y. Aida* 769 (KYO). —Hidaka: Hidaka-cho, Sarugawa, Jun. 27, 1987, *J. Haginiwa* JH021251 (TNS); Sarugawa, Jul. 2, 1952, *N. Nishimura* (SAPS 009829); Niikappu-gun, Niikappu-cho, Niikappu-river, 320 m alt., Jun. 24, 1991, *Y. Koga* 9094 (KYO); Niikappu, Perari, Jun. 30, 1939, *M. Tatewaki* (SAPS 009826); Samoni Saudo, Jun. 19, 1884, *K. Miyabe* (SAPS 009761); Mt. Apoi, Jun., 1927, *M. Tsushima*

(SAPS 009762). —Kamikawa: Asahikawa, Jul. 7, 2003, *C. Tsutsumi, K. Watanabe & H. Hongo* L3 (TNS); Kamuikotan, Jul., 1914, *H. Koidzumi* 66577 (TNS). —Iburi: Iburi, Eniwa-dake, Jul., 1906, *Majima* (SAPS 005677); Chitose, Aug. 8, 1902, *K. Miyabe & S. Arimoto* (SAPS 009758); Yufutsu-gun, Hobetsu-cho, Jul. 1, 1994, *S. Umezawa* (TUS); Shikotsu, Aug. 5, 1902, *K. Miyabe & S. Arimoto* (SAPS 009831); Tomakomai-shi, Between Lake Shikotsu and Tomakomai city, Jul. 13, 1984, *H. Takahashi* 5073 (SAPS 009775); Iburi-shi, Tomakomai, Jul. 6, 1931, *Y. Tomimoto* C2571 (TI). —Abashiri: Monbetsu-gun, Jul. 8, 2003, *C. Tsutsumi, K. Watanabe & H. Hongo* L4 (TNS). —Kushiro: Akan-gun, Akan-cho, Lakeside-Akan, 430 m alt., Jul. 5, 1981, *K. Takita* 412 (KYO); Kushiro, Lake Kutcharo, at the foot of Mt. Mokoto, Jun. 22, 1933, *H. Miyamoto* (SAPS 009827).

SOUTH KOREA. Gyeonggi: Pocheon-gun, Edong-myeon, Mt. Gwangdeok, Jul. 14, 2004, *C. S. Lee & J. O. Kim* 0407061 (EWU); Pocheon-gun, Edong-myeon, Mt. Yumyeong, Jun. 23, 2005, *C. Tsutsumi & C. S. Lee* L48 (TNS). —Gangwon: Yangyang-gun, Seomyeon, Mt. Seorak, Jun. 24, 2005, *C. Tsutsumi, Y. S. Kim & C. S. Lee* L50 (TNS); Yeongwol-gun, Sangdong-myeon, Mt. Taebaek, Jul. 24, 2004, *Y. S. Kim* 0406058–0406060 (EWU). —Jeonbuk: Muju-gun, Seolcheon-myeon, Mt. Deogyu, Jun. 20, 2005, *C. Tsutsumi, C. S. Lee, K. S. Lee & N. S. Lee* L41 (TNS). —Gyeongnam: Mt. Jiri, Jun., 1935, *J. Ohwi* 6908 (KYO); Mt. Tii (Jirisan), Jul. 4, 1931, *S. Okamoto* 8735 (KYO); Mt. Jiri, Jun., 1935, *J. Ohwi* 7138 (KYO); Mts. Chiri, en route from Taeseong to Mt. Seseog-bong, Jun. 23, 1979, *K. Ueda, E. Miki & J.-H. Park* 1190 (KYO).

Notes. *Liparis koreojaponica* has been confused with *L. koreana* in taxonomic treatments in Korea and Japan. It is distinguishable from *Liparis koreana* in the following characters: the laxly arranged flowers (usually ≥ 1 cm apart), the apex of the anther cap mucronate, and the twisted lateral sepals enfolding the labellum. In comparison, *L. koreana* has closely arranged flowers (usually < 1 cm apart), the apex of the anther cap is beaked, and the lateral sepal extends to the apical part of the labellum. Based on these characters, all pictures treated as *L. koreana* and *L. makinoana* var. *koreana* in Kim & K. S. Lee (1997), Y. N.

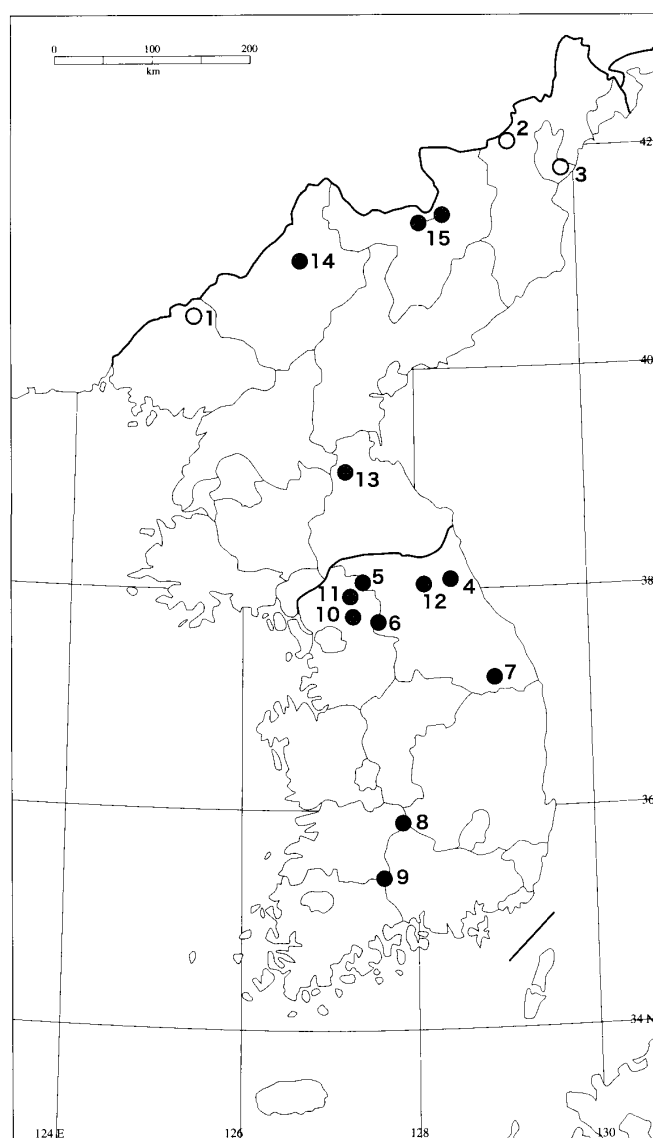


FIG. 4. Distribution map of *L. koreana* and *L. koreojaponica* in Korea. Open circles (1–3), rough localities where type and para-types of *L. koreana* were collected (Nakai 1931); solid circles (4–9), distribution of *L. koreojaponica*; gray circles (10–15), sites recorded as *L. koreana* in Kim & K. S. Lee (1997) and W. T. Lee (1996b), which may include both *L. koreana* and *L. koreojaponica*. 1: Hekido (= Byeokdong), Heihoku Prov. (= Pyeongbuk). 2: Sankari (= Samha-ri), Kanhoku Prov. (= Hambuk). 3: Ranan (= Nanam), Kanhoku Prov. (= Hambuk). 4: Mt. Seorak, Gangwon Prov. 5: Mt. Gwangdeok, Gyeonggi Prov. 6: Mt. Yumyeong, Gyeonggi Prov. 7: Mt. Taebaek, Gangwon Prov. 8: Mt. Deogyu, Jeonbuk Prov. 9: Mt. Jiri. 10: Gwangneung, Gyeonggi Prov. 11: Mt. Baegun, Pocheon, Gyeonggi Prov. 12: Yanggu, Gangwon Prov. 13: Sambang, Gangwon Prov. 14: Ganggye, Pyeongbuk Prov. 15: Samsso-Haesanjin, Ryanggang Prov.

Lee (2002) and Takizawa (2001) are identical to *L. koreojaponica*.

Japanese and Korean plants of *Liparis koreojaponica* are identical in vegetative morphology, size, and habitat; the Korean plants are variable in morphological characters and color of the flowers (N. S. Lee *et al.*, unpublished data).

Japanese populations of *Liparis koreojaponi-*

ca have been called *Oh-fugaku-suzumushi-so*, *Ezo-kumokiri-so* or *Ezo-suzumushi-so* (Takahashi 1985, 1987). They refer to the similarity with *L. fujisanensis* F. Maek. ex K. S. Matsumoto in flower morphology. *Liparis koreojaponica*, however, can be distinguished from *L. fujisanensis* by a combination of the following characters: inflorescence 15–35 cm (vs. 3–18 cm in *L.*

fujisanensis); flowers laxly arranged (usually ≥ 1 cm apart vs. < 1 cm), slender column (vs. rotund column), growing on forest floor, on rocks or on fallen tree trunks (vs. on tree trunks), and long, slender seeds with small embryo (vs. plump, short seed with large embryo; Tsutsumi *et al.* 2007).

A molecular phylogenetic analysis of sect. *Liparis* using nuclear ribosomal ITS regions and three plastid regions (*matK*, *trnL* with *trnL-trnF* spacer, *trnS-trnG* spacer) showed that plants of *L. koreojaponica* (labeled as *L. koreana*) from Hokkaido and Korea are conspecific and form a clade, which is sister to *L. fujisanensis* (Tsutsumi *et al.* 2007). In the DNA regions, *L. koreojaponica* from Hokkaido differs from the Korean plants in only a single substitution in the *trnL* with *trnL-trnF* spacer. In contrast, *L. koreojaponica* and *L. fujisanensis* are distinguishable by nine substitutions in the plastid regions, although they have identical sequences in the nuclear ITS region. Our phylogenetic interpretation leads us to believe that *L. koreojaponica* is a distinct species. Our molecular data also show that *L. koreojaponica* and *L. fujisanensis* are united with *L. kumokiri* F. Maek., *L. purpureovittata* Tsutsumi, T. Yukawa & M. Kato and a clade comprising *L. japonica* and *L. makinoana* (Tsutsumi *et al.* 2007). The clade comprising *L. koreojaponica*, *L. fujisanensis*, *L. kumokiri* and *L. purpureovittata* is distinguishable from the clade of *L. japonica* and *L. makinoana* by floral characters. In all species of the former clade the anther cap is mucronate and the lateral sepal is twisted and enfolds the labellum; in all species of the latter clade the anther cap is beaked and the lateral sepal extends toward the labellum apex. Because the floral characters of the latter clade are also shared by *L. koreana*, *L. koreana* has a close relationship with *L. makinoana* and *L. japonica*, and a distant relationship with *L. koreojaponica*.

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